

Tobacco Wildfire in Wisconsin

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN
IN COOPERATION WITH
THE STATE DEPARTMENT OF AGRICULTURE

DIGEST

A tobacco disease new to Wisconsin occurred in this state during the season of 1922. This disease, known as wildfire, has shown itself to be sufficiently serious in other tobacco districts to warrant Wisconsin growers using all possible measures to prevent its occurrence in their fields. A control campaign is under way in the infested district.

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Wildfire resembles "ordinary rust" in some respects. Careful comparison shows, however, that they are quite different in appearance, but much more important is the fact that wildfire is capable of doing a hundred-fold more damage than "ordinary rust."

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Wildfire is caused by infections of the leaves produced by certain bacteria (germs). It is, therefore, infectious and can spread from leaf to leaf, plant to plant, and from farm to farm. The control of the disease depends upon preventing an excessive spread of these bacteria.

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Storms spread the disease, produce more or less wounding favoring infection, and supply moisture, without which the bacteria are unable to enter the leaf. The weather, therefore, has a very important part in determining the amount of damage done by the disease.

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Practically all bacteria die out over winter since they have no living plants on which to multiply. A few, however, escape destruction and in some manner reach the seed-beds in the spring. The best possibilities for control lie in preventing seed-bed infection.

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Plants infected with wildfire should never be transplanted to the field if it is at all possible to obtain healthy plants elsewhere. Even apparently disease-free plants from infected beds should preferably not be used.

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Plants and leaves found infected in the field should be destroyed so far as practicable. Infected material serves as a source of further spread in the field and aids in carrying the disease over into the following year.

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Tobacco Wildfire in Wisconsin

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WILDFIRE is a serious disease of tobacco which has just appeared in Wisconsin, although it has been known in other tobacco districts of the United States for about six years. In the aggregate it has caused losses amounting to millions of dollars. Tobacco growers must now recognize that they have a new disease to contend with and therefore use every precaution to prevent their fields from becoming infested.

Mild cases of wildfire resemble "ordinary rust" and for that reason it is important that growers learn to distinguish the disease and to apply control measures in time. Preventing seed-bed infection and avoiding the use of plants from infected seed-beds are possible means of control.

The Wisconsin outbreak in 1922 did not cause any considerable damage, owing largely to unfavorable weather conditions for its spread. The disease did, however, seriously threaten to destroy a few crops early in the season, indicating its dangerous possibilities under Wisconsin conditions. The fact that wildfire may cause large losses to tobacco has been amply illustrated in southern and eastern tobacco districts. Like most plant diseases, however, wildfire is sporadic and while heavy losses may occur in some seasons there may also be seasons of comparative freedom from it as has been the experience in other states.

Wildfire in Other Tobacco Districts

Wildfire first occurred to a serious extent in North Carolina in 1917, so far as is definitely known. From there it spread rapidly to other tobacco districts of the United States until now it is found in practically all the tobacco growing sections, involving as many as fourteen states. This is an exceedingly rapid spread for a plant disease in a six-year period and suggests the ease with which it may spread from farm to farm when once it has entered a district. In these other tobacco districts the damage to infected fields has varied greatly, ranging from insignificant

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amounts to almost complete destruction in any one year, and from very widespread and general damage to hardly any signs of the disease in different years. The aggregate loss in the six-year period has run, however, into millions of dollars, and although other tobacco diseases are known to produce relatively larger losses to tobacco in the United States, yet the fact remains that, in years especially favorable for wildfire, far heavier losses than yet observed may occur.

Infected Area in Wisconsin

Diseased plants from seed-beds were brought to the Experiment Station on June 14, 1922, from the town of Deerfield, Dane county, and the disease was soon after determined to be wildfire. While the original infected area in the beds was a relatively small spot, the disease later spread over most of the beds from which about twelve acres were transplanted. As an eradication measure this planting was destroyed and replanted with healthy plants. No further signs of infection were seen on this farm until late in the season, when very slight spotting was noted in a small percentage of the plants.

About one week after the first case was reported, a second one was found in the town of Burke and a preliminary survey showed that several cases existed in this township. Arrangements were then made with the State Department of Agriculture to co-operate in checking or eradicating the disease.¹ A conference of tobacco growers from the town of Burke and vicinity was then called and met with officials of the State Department of Agriculture and the Experiment Station. A committee of growers to act with the officials was appointed and a campaign of control or eradication agreed upon. A detailed survey was undertaken to locate infested seed beds and fields. Wildfire was found on about ninety farms, situated largely in the northeastern part of Dane county. (Fig. 1.)

The largest number of infected farms was found in the towns of Burke, Sun Prairie and Windsor, with scattered infections in the towns of Cottage Grove, Deerfield, Westport, Dunn, Christiana, Bristol, Blooming Grove, Dunkirk, Pleasant Springs, and Madison. The inspection of fields outside these townships was

¹ This department is empowered by state law to apply measures necessary for the control or eradication of any new or dangerous plant disease.

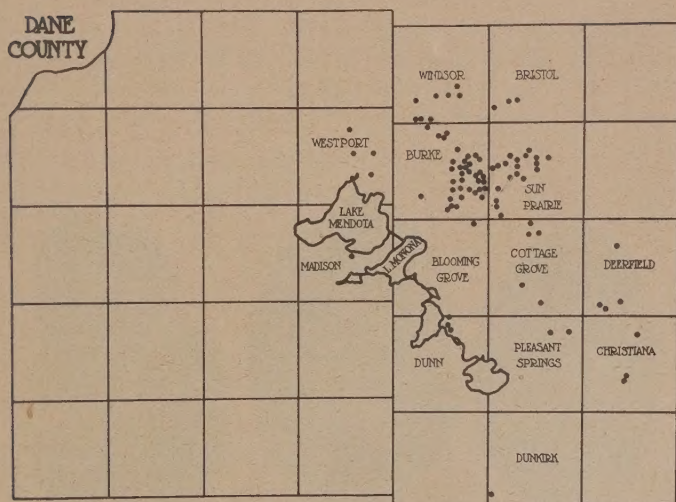


FIG. 1.—THE WILDFIRE INFESTED AREA IN DANE COUNTY

Each dot represents a farm on which wildfire was found in 1922.

complete enough to make reasonably certain that wildfire did not occur outside the area of these townships. Preliminary surveys, newspaper publicity, letters and other methods of inquiry indicate that all other tobacco-growing counties are apparently free from the disease.

The amount of infection varied from only faint signs of it to ten-acre fields in which practically every plant was infected up to the fourth or fifth leaf. The most severely infected fields bore no relation, however, to the center of the infected district. In practically every case field infection was traced to seed-bed infection. The seed used by the various growers had been obtained from widely varying sources and no relation of the seed to infection could be established.

On the basis of the survey the campaign of control and eradication was started early in July. State Department of Agriculture regulations regarding the control and eradication of wildfire were forwarded to owners of all infected fields. The first efforts at eradication were concerned with the removal of infected plants from the fields and replanting with healthy ones and destroying infected seed-beds. The most extensive work was cooperation

with the growers in removing and destroying infected leaves on farms where the disease was found too late for replanting. Half a dozen men were employed for several weeks in this way. After September 1, attention was given to the early plowing of infected

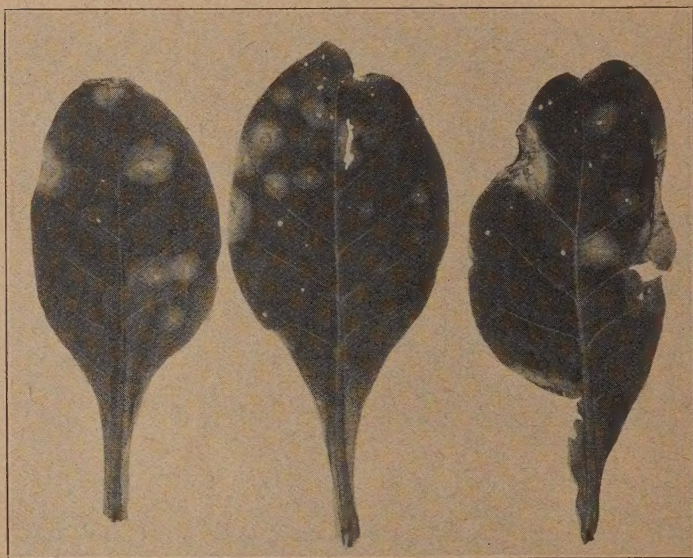


FIG. 2.—WILDFIRE STARTS IN THE PLANT-BEDS

The characteristic sign of wildfire is the yellow or bleached area around the center of infection. Watch your plant-beds for such signs on the young leaves.

fields, especially where infection started on the sucker growth. The control campaign is expected to be continued in 1923, particularly the inspecting of seed-beds and preventing the transplanting of infected plants.²

Signs of Wildfire in Plant-Beds

Wildfire may attack the plants at almost any stage of growth. On young plants it may resemble bed-rot, but the typical symptoms are quite distinct from other known diseases of tobacco. The most typical symptom in plant beds as well as in the field is a round, bleached or yellowish area (chlorotic area or halo).

² The survey and campaign for the control of wildfire was officially conducted by the State Department of Agriculture, the Experiment Station cooperating. The work of the control campaign can not be discussed in detail here, but the measures applied are essentially the same as those discussed under control measures in this bulletin.

This halo is sometimes as large as a dime and in the center is a dried area which often varies in size from a pin point up to a half inch in diameter (Fig. 2), with or without a distinctive yellow border, depending on the age of the spot and other conditions. The spots run together when numerous and may cause the whole leaf to collapse and dry up. In some seed-beds noted last spring the disease had practically destroyed all the leaves on the plants in the beds, leaving only the bare stems of the seedlings.

"Bud infection" is another symptom apparently not characteristic in other tobacco districts but fairly common in Wisconsin in 1922. In this case the young leaves surrounding the bud, and the bud itself, turned to a uniform light yellow color. (Fig. 3.)



FIG. 3.—BUD-INFECTION SOMETIMES OCCURS

The wildfire disease may affect the whole plant, with the result that it turns yellow in the bud and makes little or no further growth.

This symptom seems to result from the passage of toxic products from the infected areas through the plant to the bud, resulting in a bleaching similar to that characteristically localized in spots in older leaves. Plants so affected fail to make any growth or to recover. In some fields as high as 25 per cent of bud infection was noted. In such cases plowing under or removal of diseased plants and replanting the entire area was done. Where there are only a few cases of bud infection, infected plants should be removed and healthy plants reset in their places as soon as pos-

sible. As growers become acquainted with the signs of the disease, however, it is believed that infected plants will not be planted at all. This symptom occurred in the field probably only as the result of transplanting badly infected plants.

All infected areas in the seed-bed should be destroyed as quickly as they are noticed. It is quite unsafe to transplant even apparently disease-free plants from infected beds, and this should not be done if healthy plants can be obtained elsewhere.

Field Signs or Symptoms

Practically all wildfire infection in the field is traceable to infected plant-beds. While a few cases of seeming infection from field soil have been observed there is as yet no definite evidence that such occurs. The earliest field symptoms on young plants are, of course, about the same as those of the plant-bed, that is, leaf spots and bud infection. If infection has escaped notice, however, until the crop is one-half to full grown, some modification of the typical plant-bed symptoms may occur. While the bleached round spot with its central dead area (Fig. 4) is almost a sure sign of wildfire it is important to remember two more facts in field inspection. One is that wildfire spots sometimes occur without any bleached area surrounding them (Fig. 5), and consequently the disease is likely to be mistaken for ordinary "rust." The second is that at least one kind of "rust," the true "old-fashioned rust" of Wisconsin, also a bacterial disease, may show a fairly marked yellow area around the central point of infection when conditions are very favorable. By laboratory methods, however, all cases of true wildfire can be accurately determined.

The bottom leaves are most likely to show infection because they are exposed for the longest time and are in a better environmental position for infection. (Fig. 6.) Also, they are apparently more susceptible to the disease. Under favorable conditions for infection, however, the disease attacks with almost equal vigor the uppermost leaves, and even the suckers and seed pods. Cigar binder and wrapper tobaccos may become worthless by a comparatively few infections on a leaf, making it suitable only for stemming purposes. Heavily infected leaf ordinarily is not worth harvesting since the leaves are badly broken up in handling.

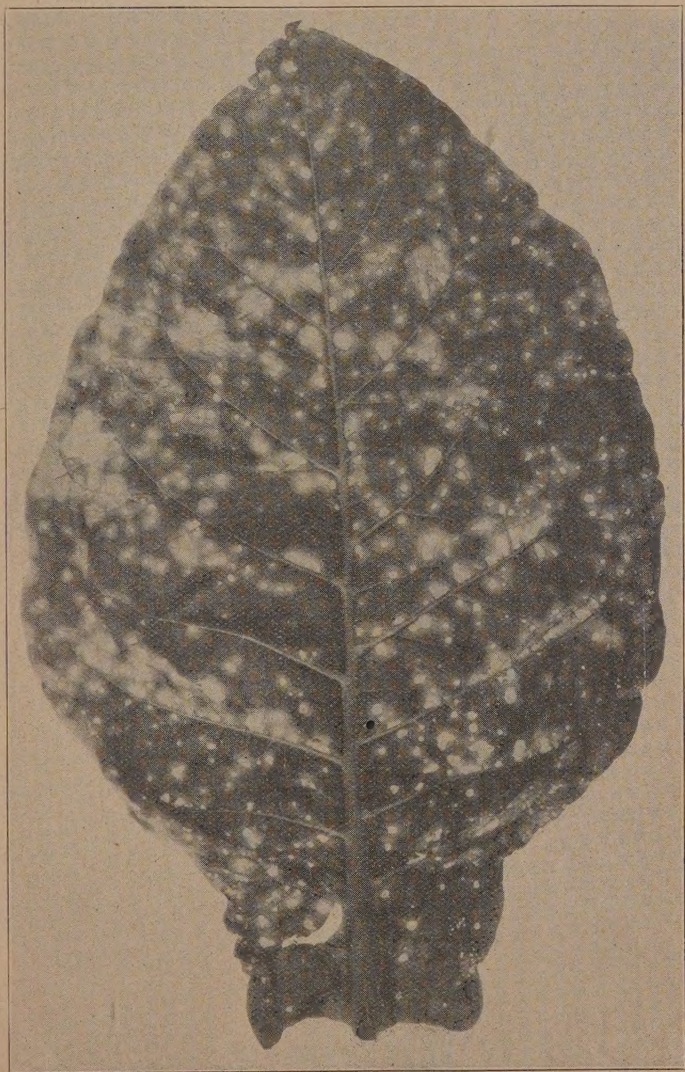


FIG. 4.—TYPICAL WILDFIRE IN FIELD

Fortunately infection is not always as heavy as here shown, but it is often worse under favorable conditions for the disease.



FIG. 5.—WILDFIRE, BUT NOT TYPICAL

Easily mistaken for ordinary rust. Little or no bleached area around spots, and these have run together and turned nearly the whole leaf to a brown color.



FIG. 6.—A FIELD INFECTED WITH WILDFIRE

Note the young spots on the upper leaves and the dried up condition of the lower leaves.

Cause of Wildfire

Most plant diseases are caused by microscopic organisms which infest and live on plant tissues. Different organisms cause different diseases and can often be recognized by the kind of decay or lesions they produce. Where such organisms are found, it is important to remember that the disease is infectious and hence may spread more or less rapidly, depending upon the vigor of the parasite, the susceptibility of the plants and the favorableness of the weather conditions for infection.

Wildfire is caused by a bacterial organism named *Bacterium tabacum*. Like all other bacteria this organism is extremely small and while one organism is enough to start a leaf-spot, hundreds of thousands of bacteria are eventually present in each spot and serve as new sources of infection. While this organism is very small it can be measured, photographed (Fig. 7), separated from all other organisms, cultivated and inoculated to healthy tobacco. The typical wildfire which it then produces absolutely proves it

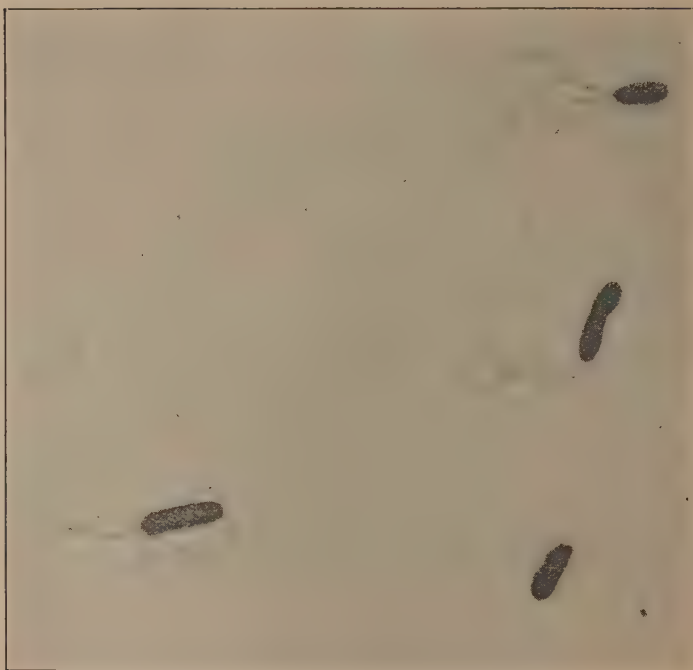


FIG. 7.—THE REAL CAUSE OF WILDFIRE

Photographed through a microscope, and enlarging to several thousand times their actual size, the wildfire bacteria look like short rods to which are attached "flagella" which enable them to move about.

to be the cause of this disease. (Fig. 8.) Without the wildfire germ it is just as impossible for the wildfire disease to occur as it is for a crop of corn to be produced in a field where no corn seed has been planted. Likewise, corn planted in dry soil fails to develop until sufficient moisture is supplied, and so while the wildfire organism may be present in great abundance rains are necessary for its development.

Conditions Favoring Wildfire

The worst periods of infection in Wisconsin in 1922 followed two separate storms with wind and some hail early in the growing season. Many growers, therefore, believed that the storm caused the "rusting" of their fields, and found it difficult to accept



FIG. 8.—THE DISEASE CAN BE PRODUCED AT WILL

The bacteria when placed on tobacco leaves in a drop of water produce spots of the same type as found under natural conditions.

the infectious nature of the disease, although many neighboring fields showed the effects of the storm but did not have wildfire. Storms, especially beating rains, however, have a very important relation to wildfire in that they favor infection to a high degree. The bacteria are often unable to infect the leaves except through slightly wounded tissue, such as may be produced by beating rain, although with rapidly growing tobacco, moisture in itself often suffices for considerable infection. The facts are, generally, that heavy infection and damage practically depend upon storms or continued rains. This does not alter the conclusion, however, that wildfire damage is first of all dependent upon the presence of bacterial organisms and that the control of the disease must depend upon preventing the general introduction of these bacteria into the seed-beds and fields.

Wildfire Compared With Other Rusts

The name "rust" is a very general one used by tobacco growers and includes many different leaf-spots due to as many different and distinct causes. The characteristics of the more common ones are as follows:

Ordinary or "old-fashioned rust" is quite similar to wildfire, but is due to a different bacterium which is much less serious and rare in its attacks on tobacco. The spots are ordinarily brown and show a less distinct, if any, yellow area around the center of infection. (Fig. 9.) The yellow area, or halo, is, on

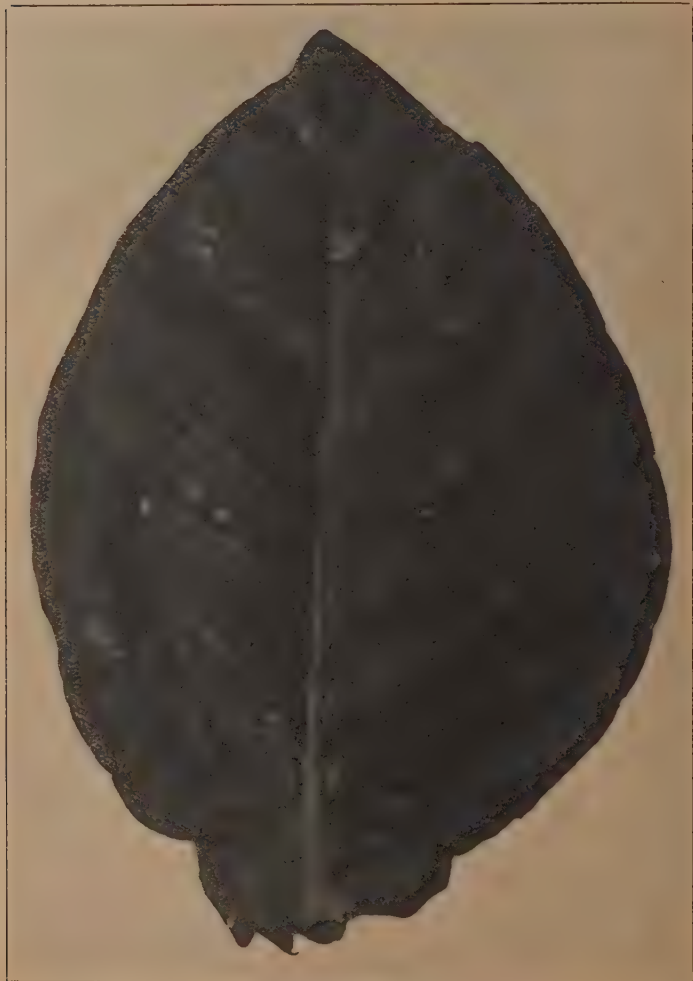


FIG. 9.—ORDINARY WISCONSIN "RUST"

This disease looks much like wildfire, but it is caused by another species of bacteria which is not nearly as apt to cause large losses as is wildfire.

the other hand, quite typical of wildfire. Ordinary rust occurs rarely, usually only on small parts of the fields, and does not spread easily and as far as known never destroys plants in the seed-bed as wildfire does.

"Mosaic rust" or "firing" was very common and serious in Wisconsin in 1922. White or brownish spots occur on the leaves and in more severe cases large patches of the leaves turn yellow or brown and dry up. (Fig. 10.) This disease is readily



FIG. 10.—MOSAIC "RUST" SOMETIMES MISTAKEN FOR WILDFIRE

This disease was common in Wisconsin in 1922. The ordinary symptoms of mosaic are shown in the two upper sucker leaves, the lower ones being healthy leaves.

recognized by the mosaic symptoms on the young leaves or suckers. The mosaic disease, itself, is indicated by leaves mottled green and yellow and often deformed. The plants are weakened as a whole and under certain weather conditions, rusting or

"firing" occurs. Commonly, no great damage is done by this disease in Wisconsin, although more or less of it can be found every year.

Non-parasitic leaf-spots or non-infectious rusts not due to germs but resulting rather from unfavorable soil conditions for tobacco, make up a third class. (Fig. 11.) They are fairly common on some soils with certain types of tobacco, and often manifest themselves in several different types or forms of spots. These spots are usually not numerous enough to cause much concern.

Many other leaf-spots or rusts occur throughout the country but are very uncommon or not known to occur in Wisconsin.

How Does Wildfire Live Over Winter?

For practically six months the wildfire germ must maintain life in some manner without any living plants upon which to feed and multiply. While there is evidence that some of these germs can live for several weeks under very unfavorable conditions as on dried leaves, seed, cloth and so forth, yet their number is reduced very rapidly. It seems, however, that a few of the germs must survive in some manner for the six-month period, probably because of being lodged in some especially favorable situation for maintaining life. If the only manner in which the disease overwinters could be determined it might greatly simplify present methods of control.

Bacteria may live over winter in a wide variety of ways, but in the case of wildfire it is difficult to find out how this is done even with the aid of practical observation and experiments. It seems likely that under certain conditions the bacteria may live over winter on the seed, but that this is not in all cases true seems evident from the data gathered on the source of seed of infected seed-beds this past season in Wisconsin. Some suspicion also falls on seed-bed covers, seed-bed frames, soil, cured tobacco leaves, tobacco refuse from sheds, tobacco stalks or any other material or equipment that may come in contact with wildfire and subsequently with tobacco plants in the spring.

It is necessary, therefore, in preparing the seed-beds in the spring to use all possible precautions to prevent infestation with wildfire on farms where wildfire has previously occurred.



FIG. 11.—ANOTHER TYPE OF RUST

These spots are different from any of the others mentioned in that no germs are concerned, but they develop rather from a combination of conditions in the soil and plant itself.

Spread of the Disease

Once infection has occurred in the spring it is not difficult to see how the disease may spread in the seed-bed, in the field and from field to field. In addition to being carried through the air under certain conditions, men, animals and tools or other equipment may carry it in various ways through the field or from field to field unless proper care is taken. The disease is most easily spread when the tobacco is wet and at such times it is a good plan to remain out of the fields when the plants have reached some size.

The transfer of infected plants for transplanting is the most evident means of spreading the disease from farm to farm and should by all means be avoided. In general the greatest injury seems to be done by an upward spread on the plants from infected lower leaves so that the greater the number of infected plants the greater the damage from the disease. On the other hand, under favorable conditions for the spread of the disease, as during driving rain storms, general spread in the direction of the wind takes place and a relatively few infected plants in the field may cause general infection to occur later. When infection has once occurred in the field, therefore, and entire replanting is not resorted to, it seems practical in many cases to break off and destroy the infected leaves and hence reduce the spread which may follow stormy or rainy periods.

Control Measures

From the foregoing discussion the possible measures for the control of wildfire are evident. The practicability of the control measures vary, however, with conditions. If, for example, most of the leaves on a half grown crop are infected, it would be impractical and too expensive to remove these leaves from stalk-cut tobacco with the purpose of profiting by reducing the infection in the remainder of the single crop. Until more experimental evidence is at hand, however, the grower may need to go to some unnecessary trouble to make certain that everything possible is done to avoid unlimited spread. This is especially important while there may still be a possibility of eradicating the disease from the state, or preventing its spread to uninfested sections.

The control measures recommended are largely concerned with growing disease-free plants in the seed-beds. If this fails healthy plants should be sought elsewhere. If diseased plants are accidentally set out the infected plants and leaves should be destroyed as soon as possible, if the infection is light and scattered. In case of general infection found before July 1 it is advisable to destroy and replant entirely. These efforts are not only for the purpose of reducing as much as possible the chances of the present crop being damaged by wildfire, but also to prevent the accumulation of infected material on the farm which serves as a source of infection for next year's crop on the same farm and vicinity.

Precautions to Prevent Infection in Seed-Beds

On farms where wildfire has once occurred the grower should take these precautions to reduce the danger of introducing wildfire into the plant-beds:

1. Locate beds a considerable distance from where tobacco beds or fields were located last year and away from tobacco sheds.
2. Do not use refuse from tobacco sheds or stripping room as fertilizer in seed-beds or field, but preferably rake it up carefully and destroy before the beds are started.
3. Use new frame boards or disinfect old boards by sprinkling or painting with some disinfecting solution such as 1 part of formalin to 25 parts of water.
4. Use new seed-bed covers, or sterilize old covers by boiling one hour.
5. Use seed known to come from uninfested districts or seed which has been disinfected. Seed may be treated most safely by using corrosive sublimate (1 part to 1,000 parts of water) into which the seed contained in a cheese-cloth bag is dipped for 10-15 minutes. Rinse thoroughly with pure water and dry as rapidly as possible.³
6. As a final measure the grower may have to resort to spraying or dusting the beds with Bordeaux mixture if the disease becomes sufficiently serious to warrant it in spite of all other precautions. Spraying or dusting should be done once a week from the time the leaves are as large as a dime until

³ Corrosive sublimate is a strong poison but will not affect the hands. It corrodes metal and for that reason a glass or wooden vessel should be used for holding the solution. It can be purchased at drug stores in convenient form.

the pulling of plants is completed. Such treatment has been found to be efficient in preventing heavy spread of infection throughout the beds. More detailed information on this subject will be furnished upon request to the Experiment Station, Madison, or State Department of Agriculture.

Do Not Transplant Infected Plants

Where wildfire infection is found in seed-beds the diseased areas and those bordering them should be destroyed at once as completely as possible. Weeding and pulling plants will especially spread the disease over large areas of the bed. The infected areas can best be destroyed by drenching with formalin (1 part to 25 parts water) and covering with some material to hold the fumes, or by cutting the plants and sprinkling the areas with kerosene and burning over. In case no further signs of the disease are evident it is fairly safe to use plants from other parts of the same beds, but plants should preferably not be pulled from within several feet of the infected areas. To be entirely safe, plants from such beds should not be used at all.

Best Methods in Case of Field Infection

When wildfire is found in the field the best procedure will depend upon the amount of disease present and the time of the season when it was first observed. If a large percentage of the plants show infection before July 1 in Wisconsin the safest thing is to destroy the planting by plowing under or pulling out all the plants, refitting the ground and replanting from healthy beds. While this method is tedious and expensive and involves the possibility of damage by frost to a later crop, it is no more discouraging than working with a crop badly damaged by wildfire.

If infection is noted on only a few plants early in the session, pull them out, carry them off the field, burn or bury them, and reset healthy plants in their places.

After July 1 planting is not ordinarily desirable and it is usually just as well to take the chance that the disease may be checked during the season by unfavorable weather conditions, together with what may be accomplished by removal of infected leaves. During the first month the tobacco is in the field serious effort should be made to remove all infected leaves, even though this means much tedious labor and expense. Even if infection

gets such a start that two to five leaves are involved on practically every plant, this measure may be profitably adopted as part of an eradication policy in place of complete destruction of the crop.

Destroy Second Growth of Suckers

Wildfire will also attack sucker growth on harvested fields in the fall if the weather is favorable. This is an additional and unnecessary possible source of infection for the farm and community. Plowing under the suckers before they make much growth will effectively prevent this danger. Fall plowing is in any case desirable as a rule from a general agricultural standpoint. Fields on which wildfire has occurred should preferably not be used for tobacco culture the following year, although it is not generally regarded as unsafe to do so.

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